WHAT IS CLAIMED IS:

1. A method, comprising:

exposing a photo-sensitive medium to an optical intensity pattern while the medium is maintained in a condition that inhibits or prevents the optical intensity pattern from producing refractive index changes in the medium; and

then, heating the exposed medium to stimulate a pattern of refractive index changes that is responsive to the optical intensity pattern during the exposing.

2. The method of claim 1, wherein the condition includes that a temperature of the medium is lower than a temperature of the medium during the heating.

3. The method of claim 1, further comprising:

exposing one or more points or lines in the medium with light that causes photo-chemical reactions in the medium via multiple-photon absorption events.

4. The method of claim 1, wherein the heating produces the pattern of refractive index changes by causing a chemical reaction selected from the group consisting of polymerization of oligomers, stimulating deprotection of portions of polymers, and stimulating crosslinking of polymers.

5. The method of claim 1, wherein the medium includes a concentration of molecules that are able to neutralize photo-chemical reaction products produced by the exposing, the products being able to stimulate the chemical reaction the produces the pattern of refractive index changes.

6. The method of claim 1, wherein the optical intensity pattern is produced by interfering at least three mutually coherent light beams.

7. The method of claim 6, wherein the pattern of refractive index changes tracks the optical intensity pattern.

8. The method of claim 6, wherein the heating causes refractive index changing reactions in regions of the medium where the exposing activated photo-sensitizer molecules dispersed in the medium.

9. The method of claim 6, wherein the heating includes heating the medium to a temperature of a rubber-like phase.

10. The method of claim 6, wherein the heating produces a pattern of refractive index changes that is periodic and non-constant in three independent directions.

11. A photo-sensitive composition, comprising:

a medium capable of undergoing a refractive index changing chemical reaction, the medium further comprising:

photo-sensitizer molecules dispersed in the medium, the photo-sensitizer molecules to stimulate photo-chemical reactions in response to being exposed to light, products of the photo-chemical reactions being able to stimulate the refractive index changing chemical reaction; and

neutralizer molecules dispersed in the medium, the neutralizer molecules being able to neutralize a portion of the products of the photo-chemical reactions.

12. The composition of claim 11, wherein one of the products and neutralizer molecules is an acid and the other of the products and the neutralizer molecules is a base.

13. The composition of claim 11, wherein the photoresist has a rubber-like phase, the index changing reactions being inhibited or prevented at temperatures below a transition temperature for the phase.

14. A method for making crystalline structures and devices, comprising:

providing a medium with photo-sensitizer molecules dispersed therein, the photo-sensitizer molecules to catalyze photo-chemical reactions in response to being activated

by light of a wavelength, products of the photo-chemical reactions being able to stimulate refractive index changes in the medium; and

exposing the medium to an optical interference pattern that is produced by combining a plurality of mutually coherent beams of light of the wavelength, the exposing being done at a temperature that inhibits or prevents the products of the photo-chemical reactions from causing the refractive index changes.

15. The method of claim 14, wherein the providing a medium includes providing a medium with a concentration of molecules to neutralize a portion of the products, the neutralized portion of the products being unable to cause refractive index changes in the medium.

16. The method of claim 14, further comprising:

heating the exposed medium to stimulate the products to cause refractive index changes in the medium.

17. The method of claim 16, wherein the photo-sensitizer molecules are visible dye molecules and the products cause polymerization, deprotection, or crosslinking reactions in the medium in response to the heating.

18. The method of claim 16, wherein the heating produces an interconnected open polymerized structure.